

Application No.: 10/722,558

Docket No.: 20140-00310-US1

REMARKS

Claims 1, 3-15 and 17-32 are now in the application. Claims 1, 3-15, 17-22, 31 and 32 are directed to the elected invention. Claims 23-30 are directed to non-elected invention and may be cancelled by the Examiner upon the allowance of the claims directed to the elected invention.

Claim 1 has been amended to recite that the dielectric layer comprises a low-k dielectric having a dielectric constant of less than 3.9 from original claim 2. Accordingly, claim 2 has been canceled. Claim 15 has been amended to recite wherein residual contamination and adhesion liner layer are removed from the bottom of the trench or via prior to depositing the first liner layer. See prior claim 16 and figure 5. Claims 5 and 19 have been amended by deleting "comprises n" for purposes of clarification and not to limit their scope. New claims 31 and 32 recite "alpha phase Ta" disclosed on page 5, penultimate line of the specification. The specification has been amended to include a missing ".". The amendments to the specification and claims and new claims do not introduce any new matter.

The rejection of Claims 1 and 3-14 under 35 USC 102(b) as being anticipated by European 1,233,448 to Lu et al. has been overcome by the above amendment to claim 1 to include recitations from claim 2.

Claim 2 was rejected under 35 USC 103(a) as being unpatentable over European 1,233,448 in view of U.S. Patent 6,486,059 to Lee et al. Lee et al. was relied upon for a disclosure of forming an inter-layer dielectric of a material such as SiLK having a dielectric constant in the claimed range.

The cited references fail to render obvious the present invention. In particular, as appreciated by the Examiner, Lu et al., does not explicitly disclose employing a low k dielectric as recited in the claims. As discussed in the specification, the present invention relates to reducing field induced metal contamination of the dielectric and/or leakage failure of the metallic interconnect and is of especial significance when the dielectric is a low-k dielectric. On the other hand, Lu et al. are concerned with eliminating overhang in liner/barrier/seed deposition and not with the problems addressed by the present invention which are especially pronounced when the dielectric is a low-k dielectric as recited in the present claims. Although, Lee et al. discloses low

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k dielectric, no motivation exists in Lee et al. or Lu et al. to suggest that the problems of reduced field induced metal contamination of low k dielectric would or could be achieved if a low k dielectric were employed in the process Lu et al.

Furthermore, the process of the present invention makes it possible to provide a pure metal contact at the bottom of the via/trench or a Ta/Cu contact which is mechanically robust and tenaciously bonded. The process of the present invention also provides for a good diffusion barrier between the electrically conductive lives such as copper and the dielectric. A comparison of Figures 9 and 10 illustrate advantages achieved by the present invention. Figure 9, which differs from the present invention in not employing the step of depositing the second liner layer 22, illustrates poor liner coverage on the bottom of the trench or via. On the other hand, Figure 10, which employs the processing of the present invention shows thick lines coverage on the bottom of the trench or via.

Claims 15-22 were rejected under 35USC103(a) as being unpatentable over European 1,233,448 to Lu et al. in view of U.S. Patent 6,893,955 to Lopatin et al. Lopatin et al. was relied upon for a disclosure of forming an adhesive film over an exposed inter-surface of a via. The cited references do not render obvious claims 15 and 17-22. It would not be obvious to include an adhesion layer in the process of the Lu et al., since the first barrier layer of Lu et al. is disclosed as having already having excellent adhesion properties. See column 2, line 53 and column 3, lines 1-5, for instance. Accordingly, no motivation exists to include a further layer in the process of Lu et al. Moreover, it would not be obvious to remove residual contamination and adhesion liner layer are removed from the bottom of the trench or via prior to depositing the first liner layer since this removal would seem to defeat the purposes of the adhesion layer and the prior art does not disclose any benefit in doing so.

In view of the above, consideration and allowance are respectfully solicited.

In the event that the Examiner believes an interview might serve to advance the prosecution of this application in any way, the undersigned attorney is available at the telephone number noted below.

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The Office is authorized to charge any necessary fees to Deposit Account No. 22-0185 under Order No. 20140-00310-US1 from which the undersigned is authorized to draw.

Dated: 2-21-06

Respectfully submitted,

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